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ABSTRACT

Trends in speech communication research reflect a multidimensional view of human behavior resulting in more sophisticated methods of design and data analysis. Factor analysis, which might be considered a first step in multivariate analysis, can generate factors in speech communication studies for use as dependent variables as demonstrated through an example of the effects of seating arrangements on persuasion. An example of research on communication denial as a cause of alienation in a small group illustrates that multivariate analysis of variance might yield significant results where separate analysis of variance would not. Multivariate statistical approaches enhance opportunities for new studies or reevaluations of old studies in areas such as attitude change and small group communication because they yield more precise analyses of data. (BLB)

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**THE ROLE OF MULTIVARIATE DATA ANALYSIS
IN SPEECH COMMUNICATION**

**Paper Presented at the Annual
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"THE ROLE OF MULTIVARIATE DATA
ANALYSIS IN SPEECH COMMUNICATION"

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One only has to read through the major journals in the field of Speech-Communication to realize that progress in the area of data analysis is in its infancy stage. The above observation points to the fact that growth in the methods of data analysis used in the field are just beginning to unfold. It is apparent that greater sophistication in design and statistical analysis have become the norm and precision the governing hand. This basic philosophy has given rise to another aspect of research that scholars in the field cannot ignore. There is now a growing need in the field of Speech-Communication to observe human behavior in light of man's multidimensional nature.

This approach to scientific research is by no means new to the behavioral sciences. As far back as 1904 Spearman, who originated the multivariate statistic factor analysis, recognized this problem. In dealing with intelligence, he states, "all branches of intellectual activity have in common one fundamental function (or groups of functions), whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all others."¹ Spearman like the many other men who followed him realized that man is composed of a multidimensional system of interrelated components. One can turn to the of personality theorists such as Cattell² to support the idea of man's complex make up. The works of Osgood, Tennenbaum

and Succi³ support the idea of man having a number of different attitude dimensions and the work of the ethos theorists gives further verification.⁴ Recent research conducted by Tucker,⁵ Bochner,⁶ Bochner,⁷ DiSalvo,⁸ Mabry,⁹ Yerby,¹⁰ Kelly,¹¹ Ware,¹² Rubin,¹³ Maffeo,¹⁴ and Bess¹⁵ give some indication of the movement of the field toward the analysis of the multidimensional complexity of communication behaviors. If one was to survey the recent journals he would find that the Bochner and Bochner study in the November issue of Speech Monographs¹⁶ is one of the few studies, utilizing the multivariate analysis of variance. This type of analysis brings new dimensions to the study of communication behavior and one can begin to view relationships between previously untested phenomena. Since further precision in communication research has been the norm, then a look at the role of multivariate data analysis merits further investigation.

According to Cooley and Lohnes, multivariate analysis can be defined as

"the branch of statistics concerned with analyzing multiple measurements that have been made on one or several samples of individuals. The important distinction is that the multiple variates are considered in combination as a system of measurement."¹⁷

One popular type of multivariate analysis used today is factor analysis. This technique has wide application in many fields and is by no means a new method. "Hundreds, perhaps thousands of cases of its application are scattered throughout the social science literature ... and it has become the calculus of such fields as sociology, psychology, and political science."¹⁸

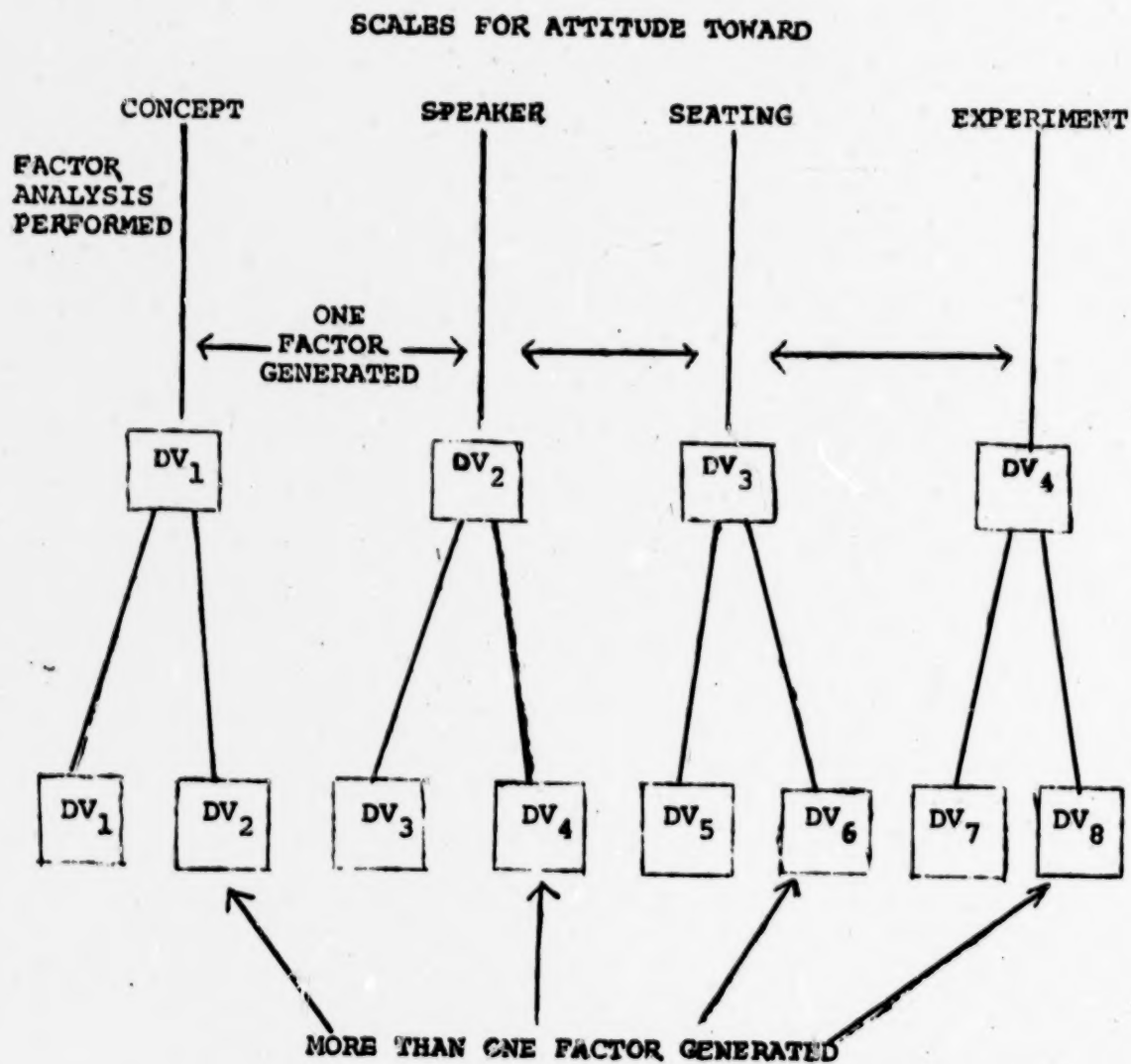
This popular statistic can be a very valuable tool to the communi-

cation researcher. One use is the reduction of a set of scales¹² in size and factoring these items into different dimension. This is the common use for factor analysis in speech communication. Once this is completed a researcher often uses each factor or at least the first factor as separate dependent variables. This technique is an acceptable way of test construction. What is advocated in this paper is that we, as researchers in the field of speech communication, begin to use these factors as dependent measures together as a system of measuring variables. A hypothetical research example may be used to elaborate the point.

Let us say that researcher Smith is attempting to study the effect of seating arrangement on the process of persuasion. The topic used was the concept of life insurance. First the researcher develops different tests which measure attitude toward the speaker, attitude toward seating, attitude toward the concept, and attitude toward the entire experiment. The researcher then will have at his control four dependent variables that are related to one another and could be used as a system. If the factor analysis performed to develop each of these measurements generated two pure factors the researcher would end up with eight possible measurements. Figure #1 shows a graphic depiction of this. (See page 4.)

The actual number of measuring instruments used in a multivariate analysis of variance can vary from two to what ever the researcher feels is reasonable. Factor analysis then may be considered the first step in this process of analyzing data through a multivariate technique. It must be understood, however, that factor analysis is not always needed but is used only as an example here.

FIGURE 1



After having discussed the use of factor analysis in developing multiple measures, we can go on to look at another type of analysis. A hypothetical example may be used to illustrate this point. A researcher is attempting to test the effect of "communication denial" as a cause of alienation in a small group.²⁰ The design of the study is as follows: two independent variables are utilized, Factor A (scores on the Berger Acceptance of Self and Others Test)²¹ contains two levels, high and low scores; Factor B (communication denial)²² contains three levels, selective participation, non-person status, and free communication. Subjects are randomly assigned to conditions according to their scores on the Berger test. Task groups are comprised of 4 members, three of which are confederates. The dependent variable used are two scales, one measuring isolation and another measuring powerlessness.

According to the body of literature contained in the speech journals, the usual tool employed would be the use of two separate two way analysis of variance. This would not provide the precision needed in analysis. The reasoning for this assertion can be explained through example. Let us assume a two way ANOVA was performed using the first dependent variable "isolation". The analysis performed produced a yield to be not significant, Table I on page 6.

TABLE 1

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F
Row	3.580	2	1.79	1.401
Column	6.457	2	3.228	2.528
R x C	5.060	4	1.265	.99
Error	252.85	198	1.277	
Total	267.947	206		

The researcher could then assume that the variables manipulated had little effect on subjects in the various conditions tested. To drive this point further, let us assume a second ANOV produced similar results, Table II below.

TABLE II

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F
Row	1.699	2	.849	.389
Column	0.169	2	.084	.038
R x C	7.093	4	1.773	0.813
Error	431.540	198	2.179	
Total	440.501	206		

It would be assumed, then, by the researcher that the variables manipulated had little effect on the subjects because of the inability to yield significance.

The point of question here is that the variables manipulated may have some effect when measured through the use of the two dependent variables as a system. If, for example, a multivariate analysis of variance was employed significance may have been attained. To take the example one step further, a look at a possible MVA yield is in order.

TABLE III
MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS

Hypothesis	Degrees of Freedom	F Ratio	P Less Than
A	3 and 93	4.876	.05
B	15 and 258	6.02	.05
A x B	15 and 258	1.04	n.s.

Two Way Multivariate Analysis of Variance.

It is entirely possible for a researcher to find significance through the use of a multivariate analysis. In this case the two dependent measures are strengthened when working as a system, therefore giving a more accurate yield. Separate analysis viewed only parts of an integrated system. It is entirely possible to have one analysis of variance yield significance and another not. It is also possible to gain significant yields in separate analysis of variance while finding no significance in a multivariate test. Regardless of the yield, the multivariate analysis is more precise and gives greater information.

The above example and information demonstrates that this type of analysis has a legitimate place in speech communication.

The use of this tool can only enhance the field. Studies utilizing the multivariate technique will help the field expand and begin to explore previously untapped areas of research. For example in many attitude change studies researchers may now test subjects on a series of related attitude tests used as a system. In the past this was done through the use of separate univariate procedures. The field of small group communication has been criticized in the past because researchers would utilize different measures, not generalizable from one study to the next. DiSalvo stated: "The use of multivariate data analysis while taking into consideration the correlation between the dependent variables, would help the researcher determine which dependent variables were consistently detecting significant differences between various treatment groups."²³ The small group researcher would be able to utilize entire systems of measurements rather than previously established single measures. This approach may be the very method that brings together a great deal of the literature in small group research.

Multivariate data analysis can only improve what already exists in the body of communication research. Eventually all Speech Communication scholars will have to face the problem of re-evaluating existing theories and updating their research methods. Univariate analysis has served its purpose and still continues to do so, but advancing the field can be more effective only when research reflects the character of its theoretical literature.

FOOTNOTES

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